

Trials@uspto.gov  
571-272-7822

Paper 27  
Entered: January 26, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

SUNSPEC ALLIANCE,  
Petitioner,

v.

TIGO ENERGY, INC.,  
Patent Owner.

---

IPR2021-01286  
Patent 8,933,321 B2

---

Before KRISTINA M. KALAN, WESLEY B. DERRICK, and  
JULIA HEANEY, *Administrative Patent Judges*.

HEANEY, *Administrative Patent Judge*.

JUDGMENT  
Final Written Decision  
Determining No Challenged Claims Unpatentable  
*35 U.S.C. § 318(a)*

IPR2021-01286  
Patent 8,933,321 B2

## I. INTRODUCTION

SunSpec Alliance (“Petitioner”) filed a Petition to institute an *inter partes* review of claims 1, 5–7, 12, and 13 of U.S. Patent No. 8,933,321 B2 (Ex. 1001, “the ’321 patent”). Paper 2 (“Petition” or “Pet.”). Tigo Energy, Inc. (“Patent Owner”) waived the filing of a Preliminary Response. Paper 7. We determined the information presented in the Petition established that there was a reasonable likelihood that Petitioner would prevail in challenging at least one of claims 1, 5–7, 12, and 13 of the ’321 patent, and we instituted this *inter partes* review as to all challenged claims. Paper 8 (“Dec. on Inst.”).

During the course of trial, Patent Owner filed a Patent Owner Response (Paper 15, “PO Resp.”), Petitioner filed a Reply to the Patent Owner Response (Paper 21, “Pet. Reply”), and Patent Owner filed a Sur-reply (Paper 23, “PO Sur-reply”).

Petitioner filed the Declaration of Randy R. Dunton (Ex. 1002) (“Dunton Declaration”) in support of the Petition. Patent Owner filed the Declaration of Robert S. Balog, Jr., Ph.D. (Ex. 2003) with its Response. The parties also filed transcripts of the depositions of Mr. Dunton (Ex. 2002) and Dr. Balog (Ex. 1030).

An oral hearing was held on November 9, 2022, and a transcript of the hearing is included in the record. Paper 26 (“Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision under 35 U.S.C. § 318(a) as to the patentability of claims 1, 5–7, 12, and 13 of the ’321 patent. For the reasons discussed below, we hold that Petitioner has not shown by a preponderance of the evidence that claims 1, 5–7, 12, and 13 are unpatentable.

IPR2021-01286  
 Patent 8,933,321 B2

*A. Real Parties-in-Interest*

Petitioner identifies itself, SunSpec Alliance, and Fronius USA LLC, MidNite Solar, Inc., SMA Technology AG, Zerun Co., Ltd., and Zhejiang Jiaming Tianheyuan Photovoltaic Technology Co., Ltd. (d/b/a JMTHY) as the real parties-in-interest. Pet. 56. Patent Owner identifies itself, Tigo Energy, Inc., as the real party-in-interest. Paper 4.

*B. Related Proceedings*

The parties identify the following litigation involving the '321 patent: *Tigo Energy Inc. v. Altenergy Power Sys. Inc.*, Case No. 5:20-cv-03622 (N.D. Cal.); and *Tigo Energy Inc. v. Altenergy Power Sys. Inc.*, Case No. 5:21-cv-02612 (N.D. Cal.). Pet. 56–57; Paper 4, 2. The parties further identify the following *inter partes* review proceeding involving the '321 patent that was terminated prior to an institution decision: *Altenergy Power Sys. Inc. v. Tigo Energy Inc.*, Case No. IPR2021-00541 (PTAB). Pet. 57; Paper 4, 2–3. The parties also identify IPR2021-01287 involving U.S. Patent No. 10,256,770, which is a continuation-in-part of the '321 patent. Pet. 56; Paper 4, 3.

*C. The '321 Patent*

The '321 patent, titled “Systems and Methods for an Enhanced Watchdog in Solar Module Installations,” relates to a system “for shutting down a photovoltaic energy generating unit when communication with a central controller is interrupted.” Ex. 1001, code (54), 1:49–51. Figure 1, reproduced below, illustrates an energy production system including a plurality of junction boxes each coupled between a solar module and a power bus. *Id.* at 2:37–39.

IPR2021-01286  
 Patent 8,933,321 B2

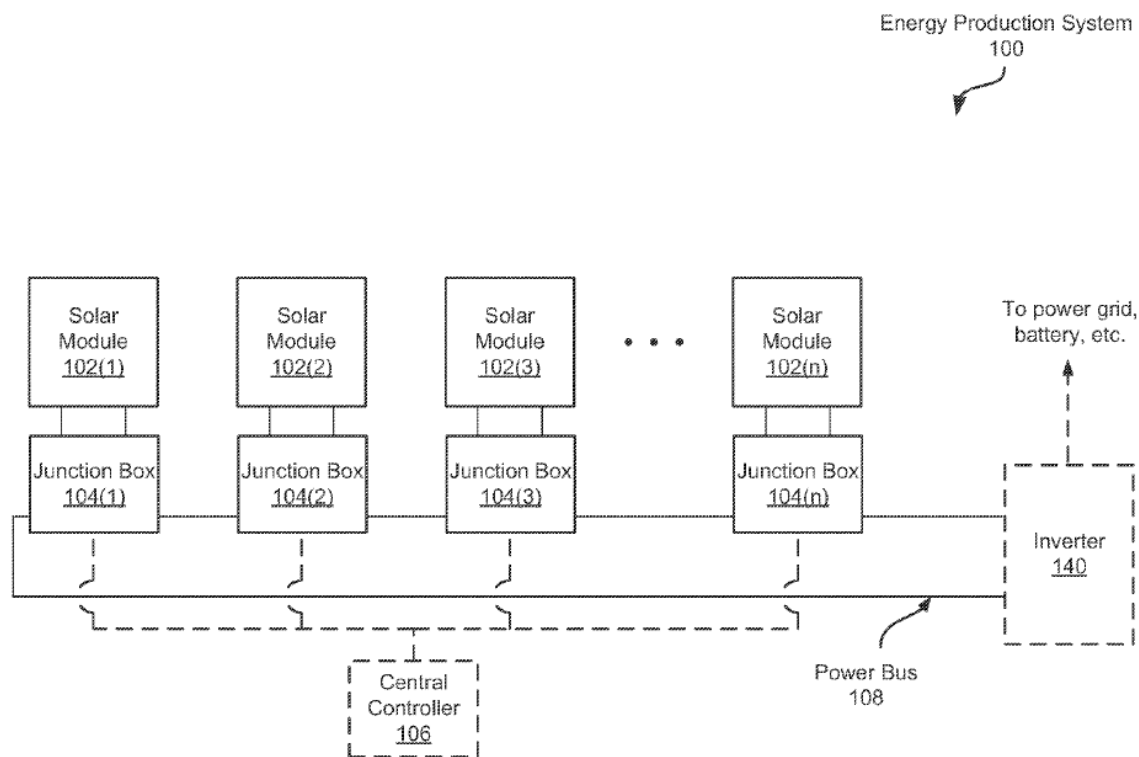


Figure 1 depicts energy production system 100 including a plurality of junction boxes 104 each coupled between solar module 102 and power bus 108. *Id.* at 3:10–12. The junction boxes control the voltage provided by the solar modules to the power bus. *Id.* at 3:14–16. The junction boxes disconnect the solar modules from the power bus, or lower the voltage provided to the power bus. *Id.* at 3:18–20. The junction boxes each comprise a watchdog unit, which monitors a communication (or signal) from central controller 106 via a wireless or wired connection. *Id.* at 3:20–23. When the communication is interrupted, each watchdog unit renders its associated solar module safe by disconnecting the solar module from the power bus or by lowering the solar module voltage to a safe level. *Id.* at 3:23–27.

IPR2021-01286  
 Patent 8,933,321 B2

Figure 2, reproduced below, illustrates a solar module and a detail view of a junction box. *Id.* at 2:40–41.

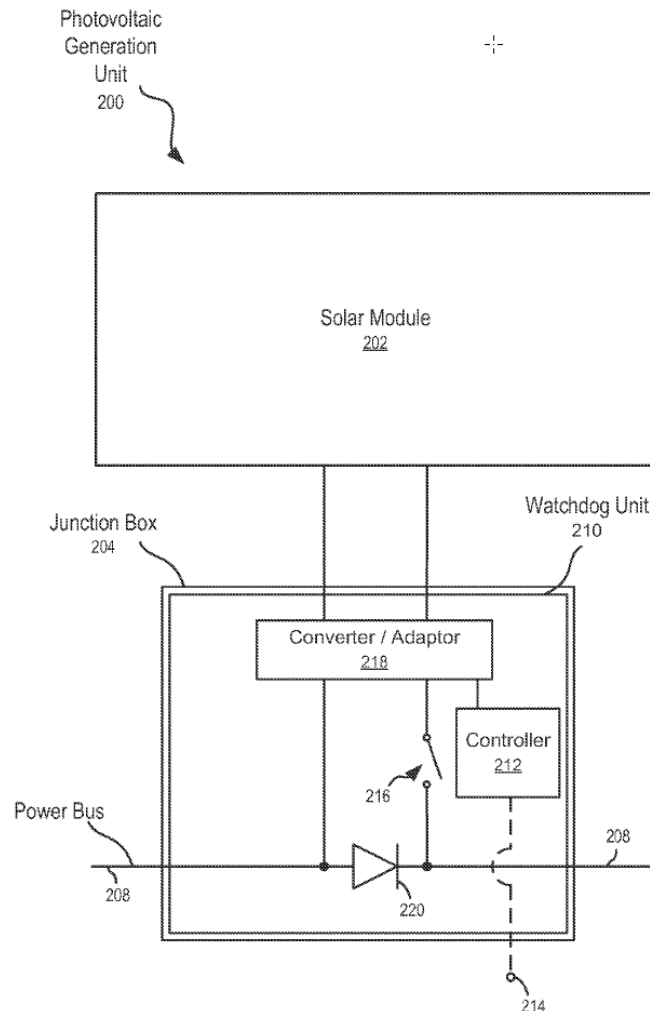


Figure 2

Figure 2 depicts solar module 202 and a detail view of junction box 204. *Id.* at 4:9–10. The junction box is coupled between the solar module and power bus 208. *Id.* at 4:10–11. The junction box includes controller 212 and switchable connection 216. *Id.* at 4:12–14. The junction box further includes watchdog unit 210. *Id.* at 4:16–17. The watchdog unit is configured to monitor a communication from central controller 106, determine that the communication has been interrupted, and disconnect the

IPR2021-01286  
Patent 8,933,321 B2

solar module from the power bus or lower the solar module voltage to a safe level. *Id.* at 4:17–21.

*D. The Challenged Claims*

Petitioner challenges claims 1, 5–7, 12, and 13 of the '321 patent. Pet. 1. Claims 1 and 12 are independent, claims 5–7 depend from claim 1, and claim 13 depends from claim 12. Claims 1 and 12, reproduced below, are illustrative of the subject matter of the challenged claims:

1. A system comprising:

a watchdog unit coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog unit having:

a local controller configured to monitor a communication from a central controller remote from the solar module and determine whether the communication has been interrupted for a time period longer than a predetermined number of allowed skips; and

at least one switch configured to disconnect the solar module from the power bus in response to a determination by the location controller that the communication from the central controller has been interrupted for a time period longer than the predetermined number of allowed skips;

wherein the watchdog unit is configured to connect the solar module to the power bus when the communication is not interrupted.

Ex. 1001, 11:18–36.

12. A system comprising:

a watchdog device coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog device configured to:

IPR2021-01286  
Patent 8,933,321 B2

verify communication with a central controller remote from the solar module; and

shutdown the solar module from the power bus if communication with the central controller cannot be verified for a time period longer than a predetermined number of allowed skips.

*Id.* at 12:11–20.

*E. Instituted Grounds of Unpatentability*

We instituted *inter partes* review on the following grounds of unpatentability, which are all the grounds presented in the Petition. Pet. 2.

Challenged Claims	35 U.S.C. <sup>1</sup>	Reference(s)/Basis
1, 6, 7, 12, 13	§ 102	Moine <sup>2</sup>
1, 6, 7, 12, 13	§ 103	Moine, Kronberg <sup>3</sup>
1, 5	§ 102	Adest '055 <sup>4</sup>

II. ANALYSIS

*A. Level of Ordinary Skill in the Art*

Factors pertinent to a determination of the level of ordinary skill in the art include: “(1) educational level of the inventor; (2) type of problems encountered in the art; (3) prior art solutions to those problems; (4) rapidity with which innovations are made; (5) sophistication of the technology; and

---

<sup>1</sup> The Leahy-Smith America Invents Act (“AIA”) included revisions to 35 U.S.C. § 103 that became effective on March 16, 2013. Because the ’321 patent claims priority from an application filed before March 16, 2013, we apply the pre-AIA versions of the statutory bases for unpatentability.

<sup>2</sup> FR Patent Application Publication No. 2894401 A1 to Moine, published June 8, 2007 (Ex. 1005).

<sup>3</sup> US Patent No. 5,054,023 to Kronberg, issued October 1, 1991 (Ex. 1006).

<sup>4</sup> US Patent No. 8,531,055 B2 to Adest et al., issued September 10, 2013 (Ex. 1007).

IPR2021-01286  
 Patent 8,933,321 B2

(6) educational level of workers active in the field.” *Envtl. Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 696–697 (Fed. Cir. 1983) (citing *Orthopedic Equip. Co. v. All Orthopedic Appliances, Inc.*, 707 F.2d 1376, 1381–82 (Fed. Cir. 1983)). Not all such factors may be present in every case, and one or more of these or other factors may predominate in a particular case. *Id.*

Petitioner argues a person of ordinary skill in the art at the time of the invention “would have had a bachelor’s degree or similar degree in electrical engineering and one year of experience in the design of solar power systems, power control systems, and/or power safety systems.” Pet. 3–4 (citing Ex. 1002 ¶ 17).

Patent Owner does not challenge Petitioner’s proposed level of skill for a person of ordinary skill in the art. Ex. 2003 ¶ 25.

Having considered the parties’ arguments and evidence, we adopt the level of ordinary skill in the art proposed by Petitioner, because it is consistent with the disclosures of the ’321 patent and the prior art of record.

### *B. Claim Construction*

We apply the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b). Under that standard, claim terms “are generally given their ordinary and customary meaning” as understood by a person of ordinary skill in the art at the time of the invention. *Phillips v. AWH Corp.*, 415 F.3d 1303 at 1312–13 (Fed. Cir. 2005) (en banc). “In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence.” *DePuy Spine, Inc. v. Medtronic*



IPR2021-01286  
Patent 8,933,321 B2

*Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

In our Decision on Institution, we determined that we did not need to explicitly construe any claim terms at that stage of the proceeding. Dec. on Inst. 8; see *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“[W]e need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’” (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999))).

Petitioner argues that the following terms in the challenged claims should be construed: “the location controller”; “disconnect” and “shutdown”; “skips”; and “communication.” Pet. Reply 3–9. Patent Owner argues “‘plain and ordinary meaning’ is all that is required” to construe terms in the challenged claims (PO Resp. 7), and includes the parties’ disputes as to the meaning of claim terms in its arguments addressing Petitioner’s challenges based on the asserted prior art. *Id.*; see *id.* at 8–9, 24–25; PO Sur-reply 6–11, 13–17. Having considered the arguments and evidence, and having decided Petitioner’s arguments as to all of the challenged claims based on Petitioner’s failure to demonstrate the prior art references disclose the “predetermined number of allowed skips” limitation (see §§ II.D.2, II.E.2, II.F.2), we address only those claim construction arguments that are necessary to resolve the dispute. See *Nidec*, 868 F.3d 1013, 1017. Thus, we do not construe the terms “the location controller”; “disconnect” and “shutdown”; and “communication,” as proposed by Petitioner.

IPR2021-01286  
Patent 8,933,321 B2

*1. “skips”*

Petitioner contends that the ’321 patent defines skips as follows: “Skips refers to the event of missing a communication or pulse.” Pet. Reply 7 (citing Ex. 1001, 9:36–37). Petitioner further argues that the ’321 patent makes clear the “communication can take any form that can be recognized by the watchdog unit 210” and the communication “can be continuous or pulsed, or periodic or non-periodic.” *Id.* at 8 (citing Ex. 1001, 4:33–36). Petitioner also relies on the following statement and examples described in the ’321 patent, as supporting the definition of “skips”:

If a communication or pulse should be received every second, but one pulse is not received, then a skip has occurred. For example, if a communication or pulse is not received for five seconds, then four skips have occurred. Additionally, the threshold can take many forms. For instance, the threshold can be a number of skips. The threshold can be a time period in which communication cannot be verified. The threshold can be a number of missed pulses or a number of pulses having less-than-expected amplitude. These are just a few non-limiting examples of the plethora of thresholds that can be used in the number of allowed skips decision 414.

*Id.* at 8–9 (citing Ex. 1001, 9:37–48).

Patent Owner does not dispute that the ’321 specification provides a definition of “skips.” *See* PO Resp. 24–25; PO Sur-reply 13–15; Tr. 65:10–66:3. Patent Owner presents argument with regard to the “predetermined number of allowed skips” limitation (although referring to it as the “skips” limitation, *see* PO Sur-reply 14), which we address below (*see* §§ II.D.2, II.E.2, II.F.2).

Having considered the parties’ positions as to construction of the term “skips” and applicability of the definition of “skips” set forth in the ’321 specification (Ex. 1001, 9:36–37), we construe the term “skips” to mean “the

IPR2021-01286  
 Patent 8,933,321 B2

event of missing a communication or pulse.” We adopt the definition set forth in the ’321 specification because patentee acted as its own lexicographer. *Cont’l Cirs. LLC v. Intel Corp.*, 915 F.3d 788, 796 (Fed. Cir. 2019) (citing *Phillips*, 415 F.3d at 1316) (“When the patentee acts as its own lexicographer, that definition governs.”). We determine that, for purposes of this Decision, no other claim term requires express construction. *See, e.g., Vivid Techs.*, 200 F.3d at 803.

### C. *Principles of Law*

“Anticipation requires that every limitation of the claim in issue be disclosed, either expressly or under principles of inherency, in a single prior art reference,” *Corning Glass Works v. Sumitomo Elec. U.S.A., Inc.*, 868 F.2d 1251, 1255–56 (Fed. Cir. 1989), and that the claim limitations be “arranged or combined in the same way as recited in the claim[],” *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1371 (Fed. Cir. 2008). However, “the reference need not satisfy an *ipsissimis verbis* test.” *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009).

### D. *Alleged Anticipation by Moine*

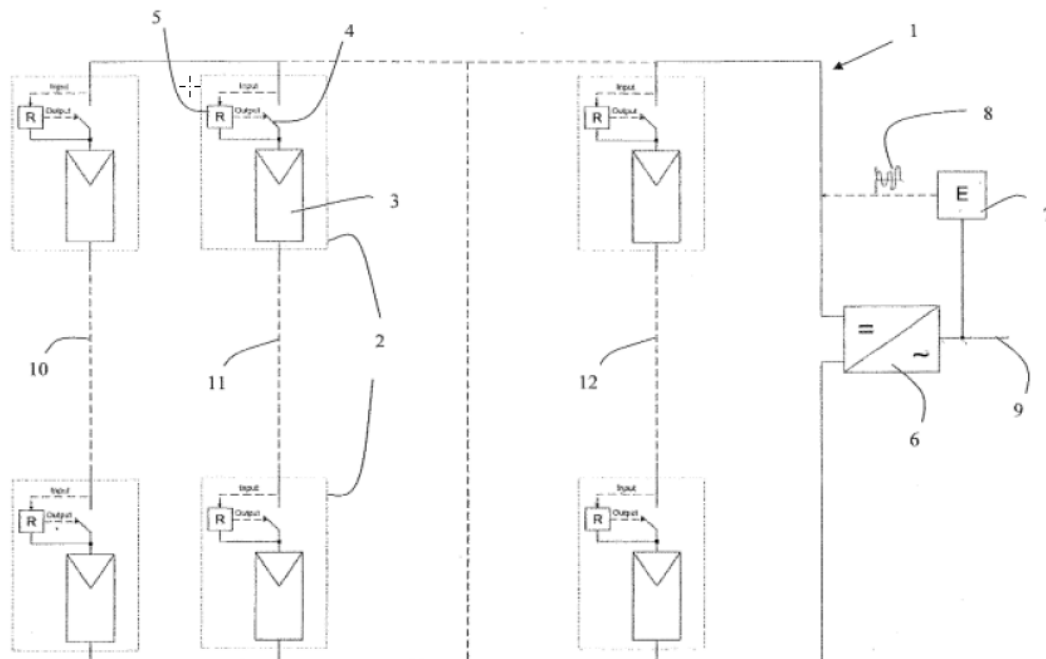
Petitioner contends Moine anticipates claims 1, 6, 7, 12, and 13. Pet. 11–24. Patent Owner contends Moine does not disclose several claim limitations, including a watchdog unit that can disconnect or shutdown a solar module from a power bus based on a predetermined number of allowed skips. PO Resp. 1, 7–26. We first discuss Petitioner’s contentions generally, then turn to the “predetermined number of allowed skips” limitation of claims 1 and 12, which we find that Moine does not disclose.

IPR2021-01286  
 Patent 8,933,321 B2

### 1. Moine (Ex. 1005)

Moine is titled “System for Controlling an Electric Power Generation Facility and Electric Power Generation Facility Implementing Such a System,” and relates to “a system for controlling an electrical power production facility” including “photovoltaic modules mounted in series and/or in parallel” to constitute “an electrical circuit,” where the electrical circuit incorporates “an electric switch capable of neutralizing the electric power provided by the output of the power terminals of [the photovoltaic] modules.” Ex. 1005, code (54), 3:11–16.

Figure 1 of Moine, reproduced below, is an illustration of a circuit in which the electrical power production facility is connected either to a domestic power supply or to an electrical load using the electricity produced. *Id.* at 4:24–26.



**Figure 1**

Figure 1 shows an electrical diagram of a photovoltaic electric power production facility. *Id.* at 4:32–33. The facility includes three series of

IPR2021-01286  
Patent 8,933,321 B2

electric generators 2 mounted in parallel. *Id.* at 5:1–3. Each of the generators is composed of a photovoltaic power module 3 that converts solar radiation into direct electric current. *Id.* at 5:5–7. Each of the modules further includes electronic switch 4, specifically a field-effect transistor. *Id.* at 5:9–10. The operation of the transistor is controlled by receiver 5, which causes the switch to open or close according to a coded signal sent as an alternating signal through power circuit 1, where the alternating signal is generated by electrically-powered transmitter 7 upstream or downstream from inverter or converter 6. *Id.* at 5:19–21, 23–27. Thus, if the transmitter detects a lack of current in a domestic power supply network or failure thereof, it stops the periodic transmission of the coded alternating signal through the circuit, whose absence, identified by the receivers, causes the latter to open the corresponding switches, such that the circuit powers down. *Id.* at 6:1–5.

## 2. Analysis

### a) Claims 1 and 12

Petitioner contends Moine discloses all of the elements of claims 1 and 12, including “a watchdog unit coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter.” Pet. 13–15, 22 (citing Ex. 1005, 4:33–5:27; Ex. 1002 ¶¶ 43–46, 70).

Petitioner further contends Moine discloses “the watchdog unit having: a local controller configured to monitor a communication from a central controller remote from the solar module and determine whether the communication has been interrupted for a time period longer than a predetermined number of allowed skips” as recited in claim 1. Ex. 1001,

IPR2021-01286  
Patent 8,933,321 B2

11:22–27. Petitioner contends Moine discloses this limitation because receiver 5 controls the operation of a transistor that opens and closes switch 4 based on a signal received by receiver 5, and thus a person of ordinary skill in the art would have understood that Moine’s receiver 5 is a “local controller.” Pet. 15–17 (citing Ex. 1005, 5:19–21, 5:58–6:1; Ex. 1002 ¶¶ 51–53). Petitioner further contends a person of ordinary skill in the art would have understood Moine discloses a “central controller” because Moine’s transmitter 7 is configured to transmit a periodic signal, and causes switches 4 to close or open by either transmitting or not transmitting the signal. *Id.* at 17 (citing Ex. 1005, 7:1–28; Ex. 1002 ¶ 55).

Petitioner further contends Moine’s receiver 5 is configured to determine whether the signal from transmitter 7 “has been interrupted for a time period longer than a predetermined number of allowed skips” as recited in claim 1, because the signal is both an alternating signal and sent according to set timing. *Id.* at 18–19 (citing Ex. 1005, 7:1–4; Ex. 1002 ¶¶ 57–60). Petitioner explains that receiver 5 would necessarily only be able to detect the absence of the signal once the set timing had elapsed, indicating that communication had been interrupted for at least one skip, because absence of the signal for a period of time less than the set timing would not indicate that the signal had been interrupted. *Id.* (citing Ex. 1002 ¶¶ 56–58).

As to claim 12, Petitioner relies on the same disclosures of Moine as discussed above for claim 1. *See* Pet. 22–24 (citing Ex. 1005; Ex. 1002 ¶¶ 70–74). Petitioner contends Moine’s transmitter and receiver “verify communication with a central controller remote from the solar module” by transmitting an alternating signal according to a set timing and detecting the absence or presence of a signal. *Id.* at 23 (citing Ex. 1005, 7:1–4; Ex. 1002

IPR2021-01286  
 Patent 8,933,321 B2

¶ 72). Petitioner further contends Moine discloses the watchdog is configured to “shutdown the solar module from the power bus if communication with the central controller cannot be verified for a time period longer than a predetermined number of allowed skips” (Ex. 1001, 12:17–20) because Moine’s transmitter and receiver communicate as described above to detect the absence of the alternating signal once a set timing has elapsed. *Id.* at 23–24 (citing Ex. 1005, 6:1–5; Ex. 1002 ¶¶ 73–74).

Patent Owner contends Moine does not disclose the “predetermined number of allowed skips” limitation in claims 1 and 12 because Moine’s disclosure of attempting to detect an AC signal and turning off the circuit upon reaching “a time period in which communication cannot be verified” is not a “predetermined number of allowed skips.” PO Resp. 25–26 (citing Ex. 1005, 7; Ex. 1002 ¶ 57; Ex. 2003 ¶¶ 58–65). Patent Owner argues that a “predetermined number of allowed skips” requires counting skips and determining if they exceed a certain number. *Id.* at 24–25. Patent Owner further argues that the “predetermined number of allowed skips” limitation “requires more than merely determining whether a communication was interrupted” because the limitation was added to the claims during prosecution in order to distinguish over prior art that merely taught determining whether a communication was interrupted. PO Sur-reply 15–17 (citing Ex. 1004, 16, 59, 63–64, 142–55, 205).

Having considered the record as a whole, we find that Moine does not disclose the “predetermined number of allowed skips” limitation. We do not agree with Petitioner that Moine’s disclosure of determining whether a “skip” (i.e., the event of missing a communication or pulse, as we have

IPR2021-01286  
Patent 8,933,321 B2

construed that term *supra*) has occurred, meets the challenged claims' requirement of determining communication has been interrupted "for a time period longer than the predetermined number of allowed skips." *See* Pet. Reply 14–15. As explained below, we determine that the "predetermined number of allowed skips" limitation does not encompass zero skips, or a mere interruption in communication from the controller, as described in *Moine*.

Claims 1 and 12 describe disconnect or shutdown of a solar module in the event of a determination that communication from a central controller has been interrupted, or cannot be verified. Both claims also condition this determination or verification on a threshold: "a time period longer than a predetermined number of allowed skips" must pass in order for the determination or verification to be made. This claim language was added during prosecution of the '321 patent. *See* Ex. 1004, 16, 59, 63–64, 142–55, 205.

In the '321 specification, the flowchart in Figure 4 illustrates a method for determining whether to shut down a solar module, and includes decision box 414 with the text "number of allowed skips exceeded?" Figure 4 is reproduced below:



IPR2021-01286  
 Patent 8,933,321 B2

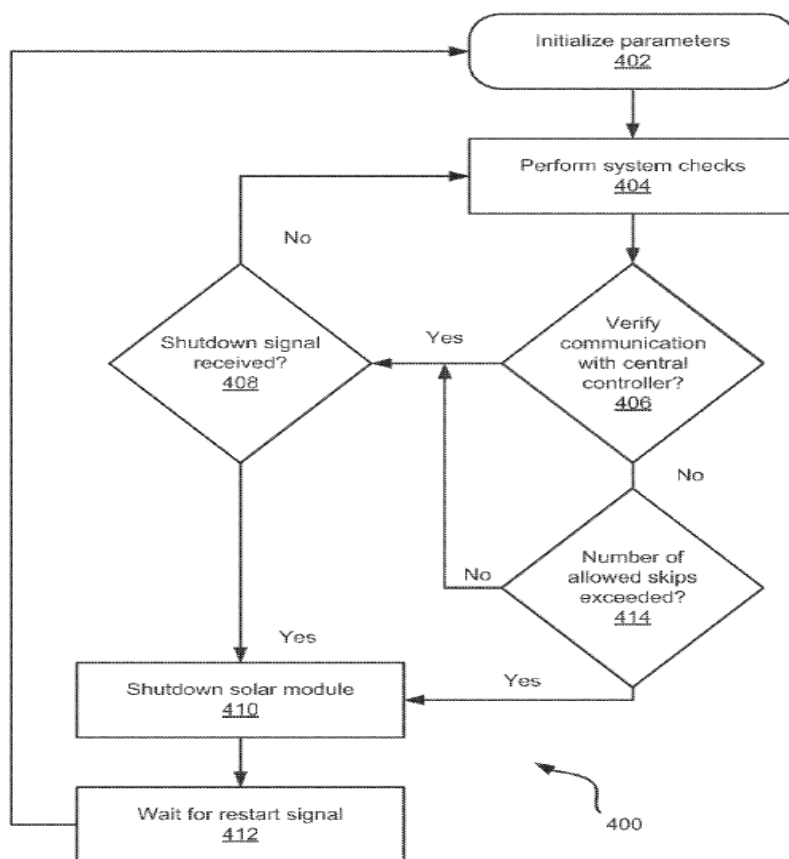


Figure 4

Figure 4 depicts a flowchart including a plurality of steps and decision points in method 400 of controlling a solar module. Ex. 1001, 7:37–38. The specification describes that, as part of the “verify communication” decision 406:

[I]f communication with the central controller cannot be verified, then the method 400 may continue trying to verify communication until a threshold is surpassed. This continued attempt to verify takes place via the number of skips allowed decision 414. Skips refers to the event of missing a communication or pulse. If a communication or pulse should be received every second, but one pulse is not received, then a skip has occurred. For example, if a communication or pulse is not received for five seconds, then four skips have occurred.

IPR2021-01286  
 Patent 8,933,321 B2

Additionally, the threshold can take many forms. For instance, the threshold can be a number of skips. The threshold can be a time period in which communication cannot be verified. The threshold can be a number of missed pulses or a number of pulses having less-than-expected amplitude.

*Id.* at 9:32–45 (emphasis added). The specification also describes:

The communication can take any form that can be recognized by the watchdog unit 210. For instance, the communication can be continuous or pulsed, or periodic or non-periodic.

*Id.* at 4:33–36. The underlined passages above highlight several examples of thresholds that may be used in the “number of allowed skips” decision, i.e., a number of skips, a time period in which communication cannot be verified, or a number of missed pulses. *Id.* at 9:42–45.

In light of the ’321 specification’s description of types of thresholds for determining or verifying communication, the claim language “a time period longer than a predetermined number of allowed skips” is directed both to a time period in which communication cannot be verified, and to a threshold requiring a predetermined number of allowed skips that defines the time period. In other words, the claim language describes a time period threshold in relation to a predetermined number of allowed skips, and the “predetermined number of allowed skips” limitation must be given effect. The prosecution history of the ’321 patent further supports this interpretation, because the “predetermined number of allowed skips” limitation was added in order to distinguish over prior art that did not teach monitoring for a predetermined number of skips. *See* Ex. 1004, 16, 59, 63–64, 142–55, 205.

As originally filed, claim 1 did not include the “predetermined number of allowed skips” limitation, and only recited determining or

IPR2021-01286  
 Patent 8,933,321 B2

verifying “whether the communication is interrupted.” Ex. 1004, 205. After a prior art rejection in which the Examiner relied on a circuit that monitored communication from a central controller and disconnected a solar module if communication was interrupted, claim 1 was amended as shown in the image of the claim amendment reproduced below:

1. (Currently Amended) A system comprising:
  - a watchdog unit coupled between a solar module and a power bus, the power bus configured to connect a plurality of solar modules to an inverter, the watchdog unit having:
    - a local controller configured to monitor a communication from a central controller remote from the solar module and determine whether the communication [[is]] has been interrupted for a time period longer than a predetermined number of allowed skips; and
    - at least one switch configured to disconnect the solar module from the power bus [[when]] in response to a determination by the location controller that the communication from the central controller has been [[is]] interrupted for a time period longer than the predetermined number of allowed skips;
  - wherein the watchdog unit is configured to connect the solar module to the power bus when the communication is not interrupted.

The image reproduced above illustrates the amendment to claim 1, including the language “for a time period longer than the predetermined number of allowed skips” underlined to show that it was added. Ex. 1004, 59. The same limitation was added in an amendment to claim 12. *Id.* at 60.

Following the amendment, the Examiner issued a Notice of Allowance including the following statement:

The prior art does not teach or suggest the featured amended into the present independent claims. Notably, the structure requiring ... the monitoring of a predetermined number of skips is not taught or suggested by the prior art in combination with the other claimed features.

*Id.* at 16.

IPR2021-01286  
Patent 8,933,321 B2

In view of this prosecution history of claims 1 and 12, and our interpretation of the claim language in light of the specification, we do not agree with Petitioner that Moine reads on those claims. The claims require that the decision whether to shut down a solar module includes determining or verifying that communication has been interrupted “for a time period longer than a predetermined number of allowed skips.” Petitioner does not identify any disclosure in Moine involving a predetermined number of allowed skips, but relies on Moine’s description of detecting the absence of a signal once a set timing elapsed, as an indication that communication was interrupted. *See* Pet. 18–19 (citing Ex. 1005, 7:1–4; Ex. 1002 ¶¶ 56–60); Pet. Reply 14–15. This does not satisfy claims 1 and 12 because Moine merely detects an interruption, not a “time period longer than a predetermined number of allowed skips.”

Although Petitioner’s counsel argued at oral hearing that a communication interruption for a specified time period satisfies the limitation “for a time period longer than a predetermined number of allowed skips” (*see* Tr. 81–84), we do not find that argument persuasive. Petitioner’s argument does not take into account that in order for the “predetermined number of allowed skips” limitation to be given effect, consistent with the claim amendment in the prosecution history, the number of skips must be predetermined as at least one. Petitioner’s argument that the claim language does not recite a limitation on the number of skips or call out “a specific number” (*see* Tr. 82) ignores the prosecution history, as described above. Further, we disagree with Petitioner’s argument that a “skip” can occur at time zero, based on the construction of “skip” as “the event of missing a

IPR2021-01286  
 Patent 8,933,321 B2

communication or pulse,” because a communication or pulse that has not yet started cannot already be missed. *See* Tr. 84–85.

*b) Conclusion as to Claims 1 and 12*

Petitioner fails to adequately demonstrate that Moine discloses the “predetermined number of allowed skips” limitation of claims 1 and 12. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claims 1 and 12 are anticipated by Moine.

*c) Claims 6, 7, and 13*

Claims 6, 7, and 13 depend from claims 1 and 12. Petitioner’s argument as to these dependent claims does not remedy the deficiency discussed above with respect to independent claims 1 and 12. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claims 6, 7, and 13 are anticipated by Moine.

*E. Alleged Obviousness Based on Moine and Kronberg*

Petitioner argues that to the extent there is any question whether Moine anticipates claims 1, 6, 7, 12, and 13, the combined teachings of Moine and Kronberg render those claims obvious. Pet. 25–36. Patent Owner argues Petitioner present an inadequate rationale for combining Moine and Kronberg. PO Resp. 27–35.

*1. Kronberg (Ex. 1006)*

Kronberg is titled “‘Smart’ Watchdog Safety Switch,” and relates to “a method and apparatus for monitoring the output signal of process control equipment and for shutting down process equipment in the event of control equipment failure” through the usage of a “‘smart’ watchdog safety switch.” Ex. 1006, code (54), 2:5–9, 30.

IPR2021-01286  
 Patent 8,933,321 B2

Figure 1 of Kronberg, reproduced below, shows the circuitry of process equipment including a “smart” watchdog safety switch. *Id.* at 2:50–51.

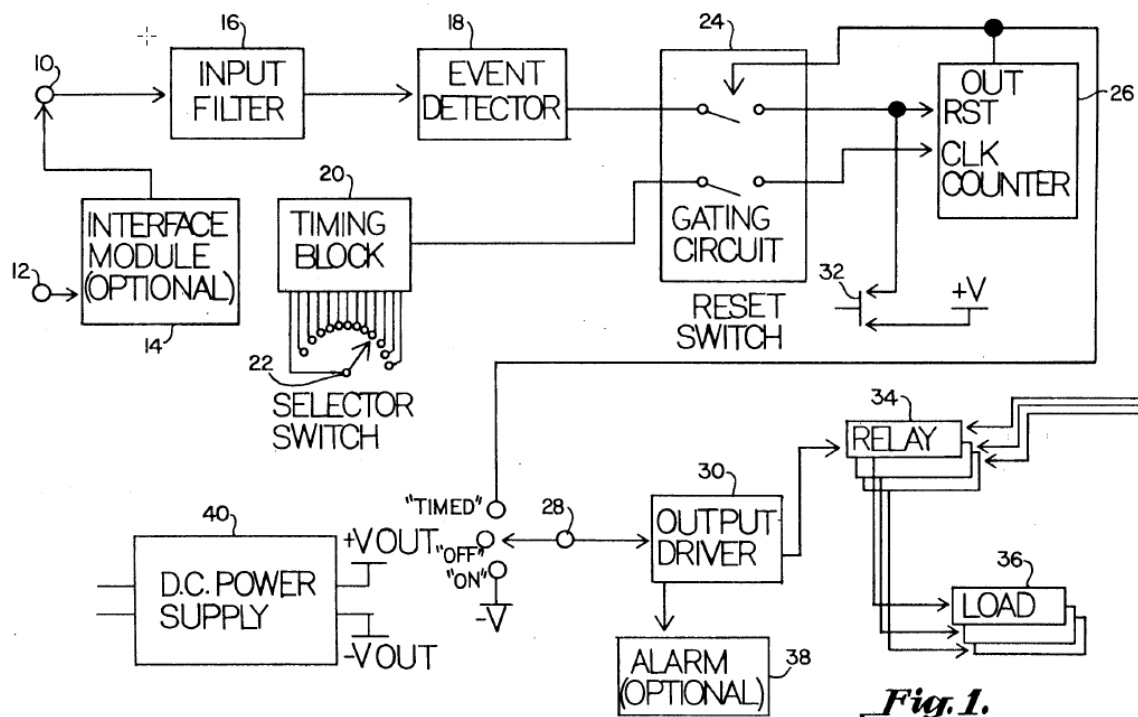


Figure 1 depicts components that make up the circuit corresponding to the process equipment. *Id.* at 3:4–12. The signal to be monitored is introduced at input 10. *Id.* at 3:13. A filtered output of input filter 16 enters event detector section 18 where valid transitions in the signal are identified and marked by a series of short “event” pulses. *Id.* at 3:23–26. In timing block 20, a train of timing pulses is continuously generated, having a frequency determined by the position of selector switch 22. *Id.* at 3:27–29. The timing pulses pass to gating circuit 24, which normally allows free passage to multistage binary counter 26 incremented by each timing pulse. *Id.* at 3:29–32. If no further event pulses arrive before a specified number of timing pulses, counter 26 is incremented and the output of counter 26 changes state from a logic “0” to a logic “1.” *Id.* at 3:38–43. When

IPR2021-01286  
 Patent 8,933,321 B2

logic “1” appears, gating circuit 24 blocks timing and event pulses from reaching counter 26, so that the count is frozen and the output of counter 26 remains at logic “1” until manually reset by reset switch 32. *Id.* at 3:47–51. The circuit promptly shuts down critical load elements 36 whenever valid transitions fail to arrive at input 10 within the period set by timing block 20 and counter 26. *Id.* at 4:5–9.

## 2. Analysis

Petitioner argues that to the extent the Board finds Moine’s receiver 5 is not a “watchdog unit,” Kronberg discloses a watchdog unit, as embodied in Figure 1. Pet. 25 (citing Ex. 1006, 2:30–32, Fig. 1). Petitioner contends a person of ordinary skill in the art would have been motivated to use Kronberg’s watchdog to implement Moine’s receiver to achieve a predictable outcome, because watchdog timers were a well-known technique for detecting malfunctions, and the output of Kronberg’s watchdog could be provided to the switch 4 of Moine, to open and power down Moine’s circuit. *Id.* at 26–28 (citing Ex. 1002 ¶¶ 79–85; Ex. 1006, 1:53–55, 3:38–42, 4:9–12; Ex. 1013, 1269). Petitioner “does not rely on Kronberg to remedy any failure of Moine to disclose the ‘skips’ limitations.” Pet. Reply 19.

As discussed above, we find that Petitioner fails to adequately demonstrate that Moine discloses the “predetermined number of allowed skips” limitation of claims 1 and 12. *See supra* § II.D.2. Accordingly, because Petitioner does not rely on Kronberg to remedy this deficiency in Moine, Petitioner has not demonstrated by a preponderance of the evidence that claims 1 and 12 would have been unpatentable over the combination of Moine and Kronberg.

IPR2021-01286  
 Patent 8,933,321 B2

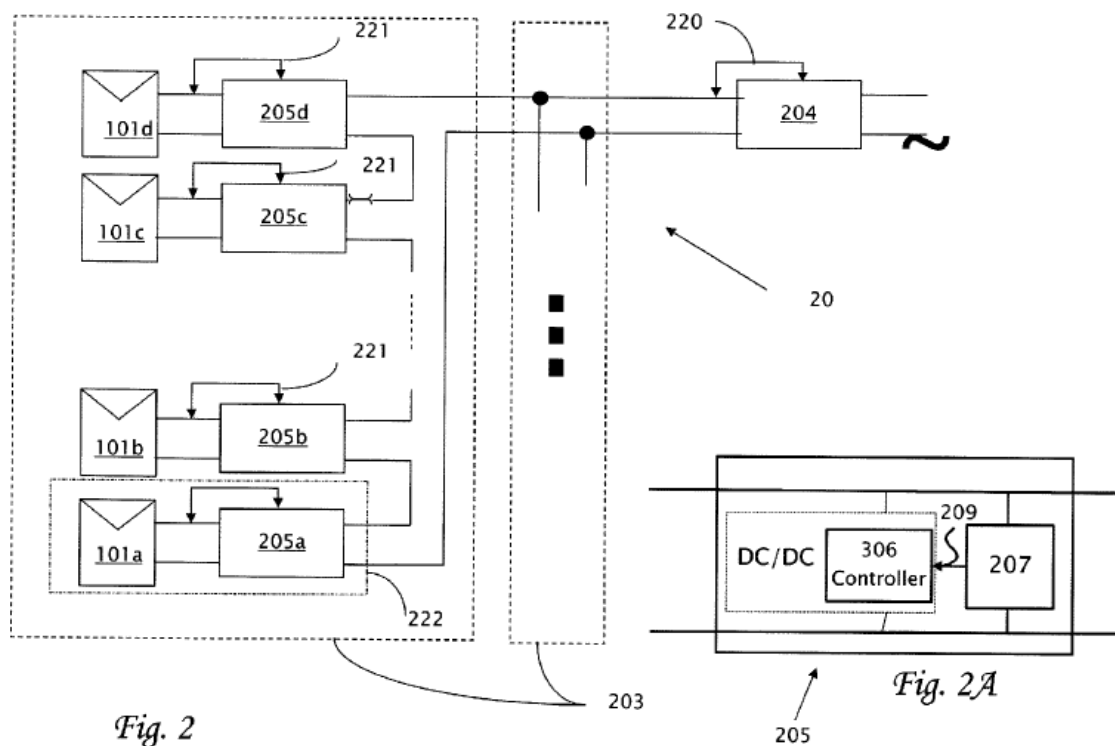
*F. Alleged Anticipation by Adest '055*

Petitioner contends Adest '055 anticipates claims 1 and 5. Pet. 37–52. Patent Owner contends Adest '055 does not disclose the “predetermined number of allowed skips” limitation of claim 1. PO Resp. 1, 7–26.

*1. Adest '055 (Ex. 1007)*

Adest '055 is titled “Safety Mechanisms, Wake Up and Shutdown Methods in Distributed Power Installations,” and relates to “wake-up and shutdown algorithms for . . . photovoltaic distributed power systems.” Ex. 1007, (54), 1:26–27.

Figures 2 and 2A, reproduced below, are block diagrams respectively illustrating a distributed power harvesting circuit and a direct-current (“DC”)-to-DC converter. *Id.* at 4:39–44.





IPR2021-01286  
Patent 8,933,321 B2

Figure 2 illustrates a distributed power harvesting circuit including power converter circuits or modules 205a–205d, and Figure 2A illustrates a converter 205 in more detail. *Id.* at 5:39–40, 6:53–55. Circuit 20 enables connection of multiple distributed power sources (*e.g.*, solar panels 101a–101d) to a single power supply. *Id.* at 5:41–43. Series strings 203 of solar panels 101 are coupled to an inverter 204. *Id.* at 5:44–45. In configuration 20, each solar panel 101a–101d is connected individually to a separate power converter circuit or a module 205a–205d. *Id.* at 5:46–48. Each solar panel 101 together with its associated power converter circuit 205 forms a power generating element 222. *Id.* at 5:49–50. Each converter 205a–205d adapts optimally to the power characteristics of the connected solar panel 101a–101d and transfers the power efficiently from input to output of converter 205. *Id.* at 5:52–55. Further, information regarding wakeup or shut-down is conveyed from inverter 204 to converters 205. *Id.* at 6:32–34.

As shown in Figure 2A, integrated with power converter 205 is a detector/receiver 207, which is configured to receive a signal originated in inverter 204. *Id.* at 6:55–59. Controller 306 either polls a signal input 209 from receiver/detector 207 or uses signal input 209 as an interrupt so that only when detector/receiver 207 detects the signal, is module 205 in a normal operating mode converting power from its input to its output. *Id.* at 6:60–64.

## 2. Analysis

Petitioner contends Adest '055 discloses all of the elements of claim 1, including a watchdog unit having a controller configured to monitor communication from a central controller and determine whether the communication has been interrupted for a time period longer than a

IPR2021-01286  
Patent 8,933,321 B2

predetermined number of allowed skips. *See generally* Pet. 37–44. Specifically, Petitioner relies on Adest ’055’s disclosure of controller 306 controlling the operation of switch 416 based on whether receiver/detector 207 receiving a 100 Hz communication signal. *Id.* at 42–43 (citing Ex. 1007, 9:34–49, 10:40–46). Petitioner contends a person of ordinary skill in the art would have understood Adest ’055’s signal mechanism 420 is a central controller that transmits the 100 Hz signal. *Id.* at 43 (citing Ex. 1002 ¶ 119). Petitioner further contends a person of ordinary skill would have understood that to detect a periodic 100 Hz is not being received, the detector would need to wait a period of time that is longer than  $1/100^{\text{th}}$  of a second in order to detect that at least one period of the 100 Hz signal is not received (i.e., is skipped). *Id.* at 44 (citing Ex. 1002 ¶¶ 123–124).

Patent Owner argues Adest ’055 does not use skips in its detection scheme, but simply determines whether the inverter is running by using either the inverter’s noise or the superimposed signal from switching relays. PO Resp. 38–39; PO Sur-reply 22. Patent Owner further argues Adest ’055 does not disclose determining whether a communication has been interrupted for a time period longer than a predetermined number of allowed skips, because Adest ’055’s system shuts down upon detecting the absence of a signal, which is not a “predetermined number of allowed skips.” PO Resp. 38–39; PO Sur-reply 22. Patent Owner relies on its argument in response to the Moine-based challenge, discussed above, that claim 1 requires more than merely determining that a signal was interrupted. PO Sur-reply 22.

IPR2021-01286  
Patent 8,933,321 B2

Having considered the record as a whole, we find that Adest '055 does not disclose the “predetermined number of allowed skips” limitation. As with Petitioner’s challenge based on Moine, Petitioner does not identify any disclosure in Adest '055 involving a predetermined number of allowed skips. Petitioner relies on Adest '055’s description of detecting the absence of a communications signal (Pet. 44), and as explained above, we do not agree that detecting the absence of a signal meets claim 1’s requirement of determining a communication has been interrupted for a time period longer than the predetermined number of allowed skips. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claim 1 is anticipated by Adest '055.

Claim 5 depends from claim 1. Petitioner’s argument as to claim 5 does not remedy the deficiency discussed above with respect to claim 1. Accordingly, Petitioner has not demonstrated by a preponderance of the evidence that claim 5 is anticipated by Adest '055.

IPR2021-01286  
Patent 8,933,321 B2

### III. CONCLUSION

Petitioner has not shown, by a preponderance of the evidence, that any of the challenged claims are unpatentable, as summarized below:

<b>Claims</b>	<b>35 U.S.C. §</b>	<b>Reference(s)/ Basis</b>	<b>Claims Shown Unpatentable</b>	<b>Claims Not Shown Unpatentable</b>
1, 6, 7, 12, 13	102	Moine		1, 6, 7, 12, 13
1, 6, 7, 12, 13	103	Moine, Kronberg		1, 6, 7, 12, 13
1, 5	102	Adest '055		1, 5
<b>Overall Outcome</b>				1, 5, 6, 7, 12, 13

### IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has not shown by a preponderance of the evidence that claims 1, 5, 6, 7, 12, and 13 of the '321 patent are unpatentable; and

FURTHER ORDERED that because this is a Final Written Decision, parties to this proceeding seeking judicial review of our decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

IPR2021-01286  
Patent 8,933,321 B2

PETITIONER:

Philip Marsh  
Michael Nguyen  
ARNOLD & PORTER KAYE SCHOLER LLP  
philip.marsh@apk.com  
michael.nguyen@arnoldporter.com

PATENT OWNER:

Heath J. Briggs  
Leif Olson  
GREENBERG TRAURIG LLP  
briggsh@gtlaw.com  
olsonl@gtlaw.com